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Preface

This book has been written to meet the growing requirements of candidates appearing for State Engineering Service Examination, Junior Engineer, Public Sector Units, RRB-JE and Metro Exams. Though every candidate has ability to succeed but competitive environment, in-depth knowledge, quality guidance, time management and good source of study is required to achieve goals.

This book includes Multiple Choice Questions (MCQ Volume-II) which works as a mock exam practice for the reader. Questions of all the subject have been organized in systematic, concepts oriented and error less manner so that it become easy and interesting for even a beginner to understand. It is a very convenient book and must be solved by candidate aiming for competitive exams.

After solving this booklet students can feel encouraged and develop confidence to attempt each and every type of numerical as well as theoretical problems. Each problems explains solving approach so that at the end, so the reader is well equipped to be able to apply any type of problem solving requirement and distinctly choose one strategy or type from the other.

We hope this book will be proved an important tool to succeed in State Engineering Service Examination, Junior Engineer, Public Sector Units, RRB-JE and Metro Exams.

It is earnestly hoped that with the extensive additions and revisions, the present edition will facilitate the students not only in preparing themselves for competitive examinations but also in preparing for their regular examinations and prove more useful to the students than the earlier editions.

Even though, enough readings were given for correcting the error and printing mistakes, due to human tendency there could be some minor typos in the book. If any such typos found, they will be highly appreciated and incorporated in the next edition. Also, please provide your valuable suggestions at :engineers.academy.india@gmail.com

All the Best!

Engineers Academy Editorial Board

CONTENTS

UNIT-I

STRENGTH OF MATERIALS

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CHAPTER 1

INTRODUCTION

OBJECTIVE QUESTIONS

1. Actual rupture stress is

(a) Breaking stress

(b) Maximum load/original cross-sectional area

(c) Load at breaking point/true strain

(d) Load at breaking point/neck area

2. Elasticity of various materials is controlled by its

(a) Ultimate tensile stress

(b) Proof stress

(c) Stress at yield point

(d) Stress at elastic limit

3. Ratio of lateral strain to linear strain within elastic limit, is known as

(a) Young's modulus

(b) Bulk modulus

(c) Modulus of rigidity

(d) Poisson's ratio

4. Ratio of direct stress to volumetric strain in case of a body subjected to three mutually perpendicular stress of equal intensity, is

(a) Young's modulus

(b) Bulk modulus

(c) Modulus of rigidity

(d) None of the above

5. If a material expands freely due to heating it will develop

(a) Thermal stresses (b) Tensile stress

(c) No stress (d) Bending

6. In a tensile test, near the elastic limit zone,

(a) Tensile strain increases more quickly

(b) Tensile strain decreases more quickly

(c) Tensile strain increases in proportion to the stress

(d) Tensile strain decreases in proportion to the stress

7. The property of a material by virtue of which it can be beaten or rolled into plates is called

(a) Malleability (b) Ductility

(c) Plasticity (d) Elasticity

8. Change in the unit volume of a material under tension with increase in its Poisson's ratio will

(a) Increase (b) Decrease

(c) Remain same (d) Unpredictable

9. The phenomenon of slow extension of the material, i.e. stress increasing with the time at a constant load is called

(a) Creeping (b) Yielding

(c) Breaking (d) Plasticity

10. For steel, the ultimate strength in shear as compared to in tension is nearly

(a) same (b) half

(c) one-third (d) two-third

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11. Tensile strength of a material is obtained by dividing the maximum load during the test by the

(a) Area at the time of fracture

(b) Original cross-sectional area

(c) Average of (a) and (b)

(d) Minimum area after fracture

12. Maximum elastic strain energy that can be stored in a body is known as

(a) Impact energy (b) Resilience

(c) Proof resilience (d) None of the above

13. Proof stress

(a) Is the safest stress

(b) Causes a specified permanent deformation in a material, usually 0.1%-0.2%

(c) Is used in connection with materials like mild steel

(d) Does not exist

14. A material having same properties in all directions at a given point is known as

(a) Orthotropic material

(b) Isotropic material

(c) Elastic material

(d) Homogenous material

15. The Bulk modulus K, the modulus of rigidity N and Poisson's ratio 1/m are related by

(a) $\frac{1}{m}=\frac{9KN}{3K+N}$ (b) $\frac{1}{m}=\frac{3K-2N}{2N+6K}$

(c) $\frac{1}{m}=\frac{6K+2N}{3K-2N}$ (d) None of the above

16. The stress at which extension of the material takes place more quickly as compared to the increase in load is called

(a) Elastic point of the material

(b) Plastic point of the material

(c) Breaking point of the material

(d) Yielding point of the material

17. When it is indicated that member is elastic, it means that when force is applied, it will

(a) Not deform (b) Be safest

(c) Stretch (d) Not stretch

18. A material capable of absorbing large amount of energy before fracture is known as

(a) ductility (b) toughness

(b) resilience (d) shock proof

19. If the thickness and width of each plate of a laminated spring be t and w respectively, then its moment of inertia is equal to

(a) $\frac{wt^3}{12}$ (b) $\frac{t^2w^3}{12}$

(c) $\frac{wt^2}{12}$ (d) $\frac{tw^2}{12}$

20. During a tensile test on a specimen of $1cm^2$ cross-section, maximum load observed was 8 tonnes and area of cross-section at neck was 0.5 cm^2. Ultimate tensile strength of specimen is

(a) 4 tonnes/cm^2 (b) 8 tonnes/cm^2

(c) 16 tonnes/cm^2 (d) 22 tonnes/cm^2

21. A material obey's hooke's law up to

(a) Plastic limit

(b) Elastic limit

(c) Yield point

(d) Limit of proportionality

22. True stress-strain curve for materials is plotted between

(a) Load/original cross-sectional area and change in length/original length

(b) Load/instantaneous cross-sectional area and $\log_e\left(\frac{\text{Original area}}{\text{Instantaneous area}}\right)$

(c) Load/instantaneous cross-sectional area and change in length/original length

(d) Load/instantaneous area and instantaneous area/original area

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23. The intensity of stress which causes unit longitudinal is called

(a) Unit stress

(b) Modulus of rigidity

(c) Bulk modulus

(d) Modulus of elasticity

24. Modulus of rigidity is defined as the ratio of

(a) Longitudinal stress and longitudinal strain

(b) Volumetric stress and volumetric strain

(c) Lateral stress and lateral strain

(d) Shear stress and shear strain

25. The ultimate tensile stress of mild steel compared to ultimate compressive stress is

(a) Same (b) More

(c) Less (d) Unpredictable

26. Modular ratio of two materials is the ratio of

(a) Strains

(b) Stress and strain

(c) Shear stress and shear strain

(d) Moduli of elasticity

27. Elasticity of a M.S. specimen is defined by

(a) Hooke's law (b) Yield point

(c) Plastic flow (d) Proof stress

28. If a material is loaded beyond yield point stress

(a) It becomes elastic

(b) It becomes ductile

(c) Its resistance to fatigue increases

(d) It loses its tendency to return to its original shape

29. A cylindrical section having no joint is known as

(a) Jointless section (b) Homogeneous section

(c) Perfect section (d) Seamless section

30. The bulk modulus of a material is defined as the ratio of

(a) Volume change to modulus of elasticity

(b) Stress intensity to volumetric strain

(c) Volume change to original volume

(d) Pressure applied to the change in volume

31. During the tensile test of a glass rod the nature of stress-strain curve is

(a) Straight and dropping

(b) Sudden break

(c) Straight line

(d) Parabolic

32. Modulus of resilience is

(a) Property to resist shocks

(b) The property to store energy without undergoing permanent deformation

(c) An index of elasticity

(d) An index of compressibility

33. Moment of inertia of a square of side d about the diagonal is

(a) $\frac{d^4}{12}$ (d) $\frac{d^4}{24}$

(c) $\frac{d^4}{18}$ (d) $\frac{d^4}{8}$

34. Disruptive strength is the maximum strength of a metal.

(a) When subjected to three principal tensile stresses at right angles to one another and all of equal magnitude.

(b) When loaded in tension

(c) When loaded in compression

(d) When loaded in shear

35. Radius of gyration for a circular section is

(a) Directly proportional to the diameter of the section

(b) Square root of the diameter of the section

(c) Inversely proportional to the diameter of the section

(d) None of the above

36. Strain energy stored in a body of volume V with stress due to gradually applied load is

(a) $\frac{\sigma E}{V}$ (b) $\frac{\sigma E^2}{V}$

(c) $\frac{\sigma V^2}{E}$ (d) $\frac{\sigma^2 V}{2E}$

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37. A non-yielding support implies that the

(a) Support is frictionless

(b) Support can take any amount of reaction

(c) Support holds member firmly

(d) Slope of the beam at the support is zero

38. Material which exhibit the same elastic properties in given direction at all point is called

(a) Homogeneous (b) Inelastic

(c) Isotropic (d) Isentropic

39. Most elastic material is

(a) Rubber (b) Plastic

(c) Brass (d) Steel

40. The value of modulus of elasticity for mild steel is of the order of

(a) 2.1×10^8 kg/cm^2

(b) 2.1×10^6 kg/cm^2

(c) 2.1×10^7 kg/cm^2

(d) 0.1×10^6 kg/cm^2

41. Compound beams are those in which

(a) Reaction components are more than three

(b) Reaction components are three

(c) Reaction components are more than three but for each additional reaction components, one hinge is introduced.

(d) None of the above

42. Condition to determine the reactions of each support of beam is

(a) Algebraic sum of all vertical forces is zero

(b) Algebraic sum of all horizontal forces is zero

(c) Algebraic sum of all moments about any point is zero

(d) All of the above

43. Number of independent elastic constant for an isotropic, homogeneous and elastic material obeying hooke's law is

(a) 1 (b) 2

(c) 5 (d) 6

44. The capacity of a material to undergo deformation under tension without rupture is

(a) Mechanical strength

(b) Stiffness

(c) Toughness

(d) Ductility

[NTPC-DIP - Trainee]

45. Slow and progressive deformation of a material with time under constant stress is called

(a) Creep (b) Erosion

(c) Resilience (d) Fatigue

[NTPC-DIP - Trainee]

46. The resistance to fatigue of a material is measured by

(a) Elastic limit

(b) Young's modulus

(c) Ultimate tensile strength

(d) Endurance limit

[NTPC-DIP - Trainee]

47. A body having same properties throughout its volume is said to be

(a) Isotropic (b) Continuous

(c) Homogeneous (d) Uniform

[NTPC-DIP - Trainee]

48. Lateral strain ($\in'$) can be expressed as

(a) $\frac{\delta l}{l}$ (b) $\frac{l}{\delta l}$

(c) $\mu\in$ (d) $-\mu\in$

[CEMPM - 2018]

49. The ratio of modulus of rigidity to modulus of elasticity of a material for a Poisson's ratio of 0.25 would be

(a) 0.5 (b) 0.4

(c) 0.3 (d) 0.1

[NTPC-DIP - Trainee]

50. When mechanical properties of a material remain same in a particular direction at each point, such a material is called

(a) Isotropic (b) Homogeneous

(c) Orthotropic (d) Anisotropic

[NTPC-DIP - Trainee]

51. The centre of gravity of a plane lamina is not at its geometrical centre, if it is a

(a) Circle (b) Square

(c) Rectangle (d) Right-angled triangle

[NTPC-DIP - Trainee]

52. Which of the following properties of mild steel cannot be determined by a static tensile test of the sample?

(a) Ultimate tensile strength

(b) Ultimate shear strength

(c) Ductility

(d) Poisson's ratio

[NTPC-DIP - Trainee]

53. Stress relaxation is the phenomenon

(a) In which stress remains constant on increasing load

(b) Stress reduced on increasing load

(c) In which deformation tends to loosen the joint and produces a reduced stress

(d) In which parts are not loaded

54. The maximum stress a material can stand before it breaks is called the

(a) Working stress

(b) Ultimate stress

(c) Compressive stress

(d) Transverse stress

55. The value of Poisson's ratio for steel is between the range of

(a) 0.4 to 0.6

(b) 0.21 to 0.24

(c) 0.01 to 0.2

(d) 0.25 to 0.33

56. The relation between modulus of elasticity (E) and bulk modulus (k) is

(a) E = 3k(1 – 2 Poisson's ratio)

(b) E=3k(1 + Poisson's ratio)

(c) E = 3k(1 + 2Poisson's ratio)

(d) E = 3k(1 – Poisson's ratio)

57. For a linearly elastic, isotropic and homogeneous material, the number of elastic constants required to relate stress and strain is

(a) Two (b) Three

(c) Four (d) Six

[TSPSC - AE]

58. Young's modulus of elasticity and Poisson's ratio of a material are 1.25×10^5 MPa and 0.34 respectively. The modulus of rigidity of the material will be

(a) 0.4025×10^5 MPa

(b) 0.4664×10^5 MPa

(c) 0.8375×10^5 MPa

(d) 0.9469×10^5 MPa

[TSPSC - AE]

59. If a material has a modulus of elasticity of 2×10^6 kg/cm^2 and a modulus of rigidity of 0.8×10^6 kg/cm^2, then the approximate value of the Poisson's ratio of the material will be

(a) 0.25 (b) 0.31

(c) 0.45 (d) 0.20

[TSPSC - AE]

60. During tensile testing of a specimen using Universal Testing Machine, the parameters actually measured include

(a) True strain and true stress

(b) Young's modulus and Poisson's ratio

(c) Engineering stress and engineering strain

(d) Load and elongation

[TSPSC - AE]

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61. The young's modulus of a material is 125 GPa and Poisson's ratio is 0.25. The modulus of rigidity of the material is

(a) 50 GPa (b) 30 GPa

(c) 5 GPa (d) 500 GPa

62. In a tensile test, when a material is stressed beyond elastic limit, the tensile strain _____ as compared to the stress.

(a) Decreases slowly

(b) Increases slowly

(c) Decreases more quickly

(d) Increases more quickly

63. The property which enables metals to be drawn into wire is

(a) Ductility

(b) Malleability

(c) Plastic deformation

(d) Elastic deformation

[CEMPM - 2018]

64. Proof resilience is the greatest stored energy at

(a) Limit of proportionality

(b) Elastic limit

(c) Plastic limit

(d) None of these

[NTPC-DIP - ME]

65. The ratio of modulus of elasticity (E) to modulus of rigidity (G) in terms of Poisson's ratio (μ) (in case of the elastic materials) is-

(a) $2(1 - \mu)$ (b) $2(1 + \mu)$

(c) $3(1 - 2\mu)$ (d) $0.5(1 - \mu)$

[QP-Mechanical - I]

66. The property of a material to absorb energy within elastic limits is known as

(a) Elasticity (b) Toughness

(c) Tensile strength (d) Resilience

[QP-Mechanical - I]

67. Strain energy stored in a solid circular shaft is proportional to

(a) GJ (torsional rigidity)

(b) $1/(GJ)^2$

(c) (GJ)

(d) 1/(GJ)

[QP-Mechanical - I]

68. Isotropic materials are those which have the

(a) Different stressed induced in all direction

(b) Different thermal properties in all directions

(c) Same elastic property in all direction at a given point

(d) Different density throughout

[AEM]

69. The impact strength of a material is directly related to

(a) Tensile strength (b) Hardness

(c) Fatigue strength (d) Toughness

[AEM]

70. The linear relation between the stress and strain of a material is valid until

(a) Fracture stress (b) Elastic limit

(c) Ultimate stress (d) Proportional limit

[DRDO 2008]

71. In compression test, the cast iron specimen would :

(a) Would not fracture

(b) Fracture along at right angles to the axis of specimen

(c) Fracture along an oblique plane

(d) Fracture along the axis of load

[NMRC-JE-ME - 2017]

72. Moment of Inertia of the rectangle of base 80 mm and height 10 mm about its centroidal (I_{xx}) axis

(a) 6666.66 $mm^4 = I_{xx}$

(b) 5827.21 $mm^4 = I_{xx}$

(c) 7777.22 $mm^4 = I_{xx}$

(d) 6826.11 $mm^4 = I_{xx}$

[MPE - 2014]

73. The ultimate tensile strength of low carbon steel by working at high strain rate will

(a) Increase

(b) Decrease

(c) Remain constant

(d) First increase, then decrease

74. A metallic cube is subjected to equal pressure (P) on its all the six faces, If ε is volumetric strain produced, the ratio $\frac{P}{\varepsilon}$ is called

(a) Elastic modulus

(b) Shear modulus

(c) Bulk modulus

(d) Strain-Energy per unit volume

75. The relation among the elastic constant E, G and K is

(a) $E = \frac{KG}{9K+G}$ (b) $E = \frac{9KG}{K+G}$

(c) $\frac{9KG}{K+3G}$ (d) $E = \frac{9KG}{3K+G}$

76. What does the elasticity of material enables it to do?

(a) Regain the original shape after the removal of applied load

(b) Draw into wires by the application of force

(c) Resist fracture due to high impact

(d) Retain deformation produced under load permanently

77. The ratio of the moment of inertia of a rectangle about its centroidal axis to that about its base, is

(a) 1/3 (b) 1/4

(c) 3/4 (d) 4

78. Centre of gravity of a right circular cone of base radius r and height h from the base is :

(a) $\frac{3}{4}h$ (b) $\frac{1}{4}h$

(c) $\frac{3}{8}h$ (d) $\frac{1}{8}h$

79. $\sigma \propto \in$. This rule is known as

(a) Castigliano's theorem

(b) Hooke's law

(c) Young's theorem

(d) Reynold law

[CEMPM - 2018]

80. The equation for relationship between E, G & K is

(a) $\frac{1}{E}=\frac{9}{k}+\frac{3}{G}$ (b) $\frac{3}{E}=\frac{9}{k}+\frac{1}{G}$

(c) $\frac{9}{E}=\frac{3}{k}+\frac{1}{G}$ (d) $\frac{9}{E}=\frac{3}{G}+\frac{1}{k}$

81. In various geometry of the product, stress concentration factor depends on which of the following condition?

(a) Variation of geometrical cross section of the part

(b) Quality of the part

(c) Uniform geometrical cross section of the part

(d) None of these

82. Factor of safety is the ratio of

(a) Breaking stress to working stress

(b) Endurance limit to yield stress

(c) Elastic limit to ultimate stress

(d) Failure stress to working stress

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83. For a ductile material, toughness is a measure of:

(a) Resistance to scratching

(b) Ability to absorb energy upto fracture

(c) Ability to absorb energy till elastic limit

(d) Resistance to indentation

84. The load per instantaneous cross sectional area is called.....

(a) True stress (b) Shear stress

(c) Normal stress (d) Nominal stress

85. The body which is capable of transmitting forces with negligible deformation is known as.....

(a) Resistant body (b) Flexible body

(c) Reductant body (d) Rigid body

86. The value of stress corresponding to force on whose removal deformation disappears is known as.....

(a) Fracture (b) Proportionality limit

(c) Yield point (d) Elastic limit

87. What is the ability of a material to with stand bending without fracture known as?

(a) Mechanical strength

(b) Stiffness

(c) Toughness

(d) Ductility

88. Poisson's ratio for aluminium is:

(a) 0.13 (b) 0.23

(c) 0.33 (d) 0.43

89. Strain developed perpendicular to the direction of force applied is:

(a) Linear strain (b) Volumetric strain

(c) Shear strain (d) Lateral strain

90. Toughness indicates ..... of a material.

(a) Impact strength (b) Fatigue strength

(c) Tensile strength (d) Shear strength

91. The fatigue life of a part can be improved by

(a) Electroplating (b) Polishing

(c) Coating (d) Shot peening

92. Necking phenomenon in stress-strain is observed for

(a) Brittle materials

(b) Ductile materials

(c) Both brittle as well as ductile materials

(d) None of the above

93. What strength is to be considered for ductile material under cyclic load?

(a) Ultimate strength

(b) Yield strength

(c) Endurance strength

(d) Fracture strength

94. Ability of a material to exhibit considerable elastic recovery on release of load, is known as

(a) Toughness (b) Stiffness

(c) Resilience (d) Hardness

95. Thermal expansion of a solid is employed in :-

(a) Thermocouple

(b) Resistance thermometer

(c) Bulb temperature

(d) Bimetal element

96. Which of the following material has non-linear elastic behaviour

(a) Mild steel (b) Aluminium

(c) Cast iron (d) Rubber

97. For a given material, the modulus of rigidity is 100 GPa and Poisson's ratio is 0.25 the value of modulus of elasticity is GPa is

(a) 125 (b) 150

(c) 200 (d) 250

98. The modulus of elasticity for a material is 200 GN/m^2 and Poisson's ratio is 0.25 what is the modulus of rigidity?

(a) 80 GN/M^2 (b) 125 GN/m^2

(c) 250 GN/m^2 (d) 320 GN/m^2

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99. When mild steel is subjected to a tensile load, its fracture will conform to-

(a) Star shapes

(b) Granular shape

(c) Cup and cone shape

(d) Fibrous shape

100. The fracture in cast iron occur due to compression (direction of load) test along its

(a) Load

(b) Perpendicular to axis of load

(c) Oblique plane

(d) None of above

101. In stress-strain curve, value of stress at yield point is _____ than value at fatigue point:

(a) Lower (b) Higher

(c) Same (d) Twice

102. The radius of wire stretched by a load is halved then its young's modulus will be-

(a) Half (b) Unaffected

(c) Doubled (d) Become four times

103. If the modulus of elasticity is zero, the material is said to be-

(a) Rigid (b) Elastic

(c) Flexible (d) Plastic

104. Bending compressive and tensile stresses respectively are calculated based on

(a) Net area and gross area

(b) Gross area and net area

(c) Net area in both cases

(d) Gross area in both cases

105. The unit of elastic modulus is the same as those of

(a) Stress, shear modulus and pressure

(b) Strain, shear modulus and force

(c) Shear modulus, stress and force

(d) Stress, strain and pressure

106. The negative ratio of transverse to axial strain is called as :

(a) Young's modulus

(b) Shear modulus

(c) Poisson's ratio

(d) Bulk modulus of elasticity

107. What happens if a bar of length 'l' width 'b' and thickness 't' is subjected to a push of P ?

(a) Length, width and thickness increases

(b) Length, width and thickness decreases

(c) Length increases, width and thickness decreases

(d) Length decreases, width and thickness increases

108. The bending of bimetallic strips during rise in temperature is due to difference in their:

(a) Coefficient of linear expansion

(b) Thickness

(c) Thermal Conductivities

(d) Elastic properties

109. The moment of inertia of a square of side (a) about an axis passing through its center of gravity is

(a) $a^4/4$ (b) $a^4/8$

(c) $a^4/12$ (d) $a^4/36$

110. In the case of perfect elastic collision, the coefficient of restitution is :

(a) 1.0 (b) 0.5

(c) Less than 1.0 (d) Zero

111. Which of the following is the correct definition of modulus of resilience of a material?

(a) Strain energy

(b) Strain energy per unit mass

(c) Strain energy per unit volume

(d) None of these

112. Shock absorber in vehicles is used for-

(a) Absorbing the shock energy

(b) Dissipating the shock energy

(c) Increasing the shock energy

(d) Producing the shock energy

113. The property of material, which enables it to withstand bending without fracture, is known as

(a) Mechanical strength

(b) Stiffness

(c) Flexural rigidity

(d) Ductility

[UPSSSE-AE]

114. In the absence of clear yielding, criteria for yielding corresponds to:

(a) 0.5 percent strain (b) 0.8 percent strain

(c) 0.2 percent strain (d) 0.1 percent strain

[NLC India - 2020]

115. Which one of the phenomena is not used to measure hardness?

(a) Wear (b) Indentation

(c) Scratch (d) Fracture

[Vizag Steel - 2020]

116. The ratio of the ultimate stress to the design stress is known as –

(a) Elastic limit (b) Strain

(c) Factor of safety (d) Bulk modulus

[RSMSSB-13.12.2020(M)]

117. The value of Poisson's ratio depends upon:

(a) Material of the test specimen

(b) Nature of load, tensile or compressive

(c) Dimensions of the test specimen

(d) Magnitude of load

[Coal India - 27.02.2020]

118. For a Mild Steel, the Engineering stress-strain curve and True stress-strain curve are looks similar up to:

(a) Proportional limit

(b) Ultimate strength point

(c) Elastic limit

(d) Yield point

[Coal India - 27.02.2020]

119. The stress-strain curve of brittle material has:

(a) only upper yield point

(b) only lower yield point

(c) no clear yield point

(d) both lower and upper yield point

[NLC India - 17.11.2020]

120. Which material has highest value of Poisson's ratio?

(a) Elastic Rubber (b) Wood

(c) Copper (d) Steel

[DMRC - 2016]

121. The ultimate tensile strength and yield strength of most of the metals, when temperature falls from 0 to –150°C will

(a) Increase

(b) Decrease

(c) Remain same

(d) First increase and then decrease

[ISRO - 2008]

122. A 5 mm diameter aluminium alloy test bar is subjected to a load of 500 N. If the diameter of the bar at this load is 4 mm, the true strain is

(a) 0.56 (b) 0.22

(c) 0.25 (d) 0.45

[ISRO - 2013]

123. The engineering and true strains for a bar which is doubled in length during tension test are

(a) $e = 1.0, \varepsilon = 0.693$

(b) $e = 2, \varepsilon = 1$

(c) $e = \frac{1}{2}, \varepsilon = \frac{1}{2}$

(d) None of the above

[ISRO - 2012]

124. A circular rod of 100 mm diameter and 500 mm length is subjected to a tensile force of 1000 kN. Determine the modulus of rigidity (G) if $E = 2 \times 10^5$ N/mm^2 and Poisson's = 0.3

(a) 0.335×10^5 N/mm^2

(b) 0.521×10^5 N/mm^2

(c) 0.7692×10^5 N/mm^2

(d) 0.2256×10^5 N/mm^2

[ISRO - 2011]

125. Young's modulus of elasticity for a perfectly rigid body is

(a) zero (b) unity

(c) infinity (d) cannot be known

[IOF - 2013]

126. Necking phenomenon in stress-strain is observed for

(a) Brittle materials

(b) Ductile materials

(c) Both brittle as well as ductile materials

(d) None of the above

[IOF - 2013]

127. Elastic modulus of steel is

(a) 70 GPa (b) 210 GPa

(c) 250 GPa (d) 300 GPa

[IOF - 2013]

128. In tensile test of mild steel, necking will start:-

(a) At lower yield stress

(b) At upper yield stress

(c) At ultimate tensile stress

(d) Just before fracture

[UPSSSC-AE]

129. The ratio of Young's modulus and modulus of rigidity for a material having Poisson's ratio 0.2. is

(a) $\frac{12}{5}$ (b) $\frac{5}{12}$

(c) $\frac{14}{5}$ (d) $\frac{5}{14}$

[NTPC - Diploma - 2007]

130. The area under the stress-strain diagram upto the rupture point is known as

(a) Proof resilience

(b) Modulus of toughness

(c) Modulus of elasticity

(d) Modulus of resilience

[AE - 2018]

131. The modulus of elasticity and rigidity of a linearly elastic isotropic material are 200 GPa and 80 GPa respectively. What is the value of Poisson's ratio of this material?

(a) 0.30 (b) 0.28

(c) 0.25 (d) 0.22

[NTPC-Diploma - 2007, URVUNL-JE - 2014]

132. A cable is cut to half of its original length. The maximum load which the cable can support would.

(a) get reduced to half the value

(b) become two - fold

(c) remain unchanged.

(d) data insufficient to make any comment

133. In a tension test, fracture takes place along a crystallographic plane, on which the normal tensile stresses is maximum. Such plane is called

(a) Shear plane (b) Neutral plane

(c) Cleavage plane (d) Fracture plane

[JKSSB-JE]

134. Few statements about creep in materials are given below:

1. Creep means regaining the original shape after removal of stresses.
2. Creep implies development of additional strains when the material is loaded for prolonged period of time.
3. Creep is more at elevated temperatures.
4. Creep means loading the material in plastic range.

Which of the above statements are all correct?

(a) 1, 2 and 3 (b) 1 and 4

(c) 2 and 3 (d) 2 and 4

[RPSC-AEN - 2013]

135. For a material with the Poisson's ratio v, the modulus of elasticity (E) and the bulk modulus of elasticity (K) are same. Which of the following is correct?

(a) The material has v = 0

(b) The material has v = 1/2

(c) The material has v = 1/3

(d) The material has v = 3/4

[RPSC-AEN - 2013]

ENGINEERS ACADEMY

136. What is the approximate value of Young's modulus of elasticity of cast iron:

(a) 100 - 105 GPa (b) 200 - 210 GPa

(c) 240 - 250 GPa (d) None of these

[PPAME SIII]

137. A cast iron sample when tested in compression, fails at a compressive stress of 520 N/mm^2. What is its shear strength?

(a) 520 N/mm^2 (b) 260 N/mm^2

(c) 210 N/mm^2 (d) 130 N/mm^2

[NTPC - Diploma - 2007]

138. Which of the following statement is correct ?

(a) Stress is proportional of strain.

(b) Stress is force per unit area.

(c) Within elastic limit, the ratio of stress and strain is called young's modulus.

(d) All of the above

[Uttrakhand JE paper-I 2013]

139. Select the proper sequence for the following

(1) Proportional limit (2) Elastic limit

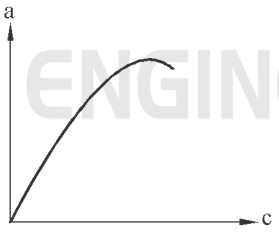
(3) Yield point (4) Fracture/Failure Point

(a) 1- 2- 3- 4 (b) 2- 1- 3- 4

(c) 1- 2- 4- 3 (d) 2- 1- 4- 3

[Uttrakhand JE Paper - II 2008]

140. The above stress - strain diagram is for



[Uttrakhand JE Paper 2013]

(a) Ductile material (b) Brittle material

(c) Soft material (d) None of these

141. Fatigue of a component is due to

(a) Cyclic load (b) Static load

(c) Constant heating (d) none of these

142. Strain is Defined as the ratio of -

(a) Change in volume to original volume

(b) Change in length to original length

(c) Change in lateral dimensions to original lateral dimensions

(d) All of the above

143. When a wire is stretched to double its original length, the longitudinal strain produced in it is-

(a) 0.5 (b) 1.0

(c) 1.5 (d) 2.0

[Chattisgarh JE Paper - II 2008]

144. The value of Poisson's ratio for any material can not exceed

(a) 2.0 (b) 1.414

(c) 1.0 (d) 0.5

[IOF JE 2014]

145. Young's modulus (Y) can be written as.

(a) $Y = \dfrac{\text{Force} \times \text{Area}}{\text{strain}}$

(b) $Y = \dfrac{\text{Force} \times \text{strain}}{\text{Area}}$

(c) $Y = \dfrac{\text{Force}}{\text{strain} \times \text{Area}}$

(d) Y = Force × Strain × Area

[UPRVUNL JE 2014]

146. The young's modulus E, the shear modulus G and the Poisson's ratio μ for a material are related by the expression.

(a) $E = 2G(1 + 4\mu)$ (b) $E = 3G(1 + 2\mu)$

(c) $E = 3G(1 + 2\mu)$ (d) $E = 2G(1 + \mu)$

147. What would be the ratio of Young's modulus and modulus of rigidity for a Poisson's ratio 0.4 ?

(a) $\dfrac{5}{12}$ (b) $\dfrac{11}{5}$

(c) $\dfrac{14}{5}$ (d) $\dfrac{1}{12}$

ENGINEERS ACADEMY

148. If 'P' is the tensile stress in a rectangular bar of length 'L' with 'b' and thickness 'd' the volumetric strain is given as.

(a) $P(1+2\mu)/E$ (b) $PL(1+2\mu)/bd$

(c) $P(1-2\mu)$ (d) $P(1-2\mu)/E$

[UPRVUNL JE 2014]

149. The modulus of elasticity in the case of rigid body is

(a) the ratio of stress to strain

(b) equal of zero

(c) equal to infinite

(d) equal to five time that of a flexible body

150. The % of elongation of the piece under tension indicates its.

(a) Brittleness (b) malleability

(c) Stiffness (d) Ductility

151. Limit of proportionality depends upon:

(a) Type of loading

(b) type of material

(c) Area of cross section

(d) all of the above

[Rajasthan JE 2015]

152. A cylindrical bar of L meter deform axially by '*l*' mm. the strain of bar is .

(a) $\frac{\ell}{L}$ (b) $0.1\frac{\ell}{L}$

(c) $0.001\frac{\ell}{L}$ (d) $100\frac{\ell}{L}$

153. A Load of 20,000 N is applied to a cylinder, 40m long and 10m diameter caused an extension of 0.8m and the diameter to decrease by 0.05m the Poisson's ratio of the material is

(a) 2.5 (b) 0.4

(c) 0.0625 (d) 0.25

154. The ratio of ultimate creep strain to elastic strain is known as

(a) Creep - modulus

(b) Creep coefficient

(c) Creep - strain ratio

(d) Teritiary creep

155. The independent elastic constants for a homogenous and isotropic material are.

(a) E, G, K, μ (b) E, G, K

(c) E, G, μ (d) E, G

❑❑❑

ENGINEERS ACADEMY

ANSWERS AND EXPLANATIONS

1. *Ans. (d)*
2. *Ans. (d)*
3. *Ans. (d)*
4. *Ans. (b)*
5. *Ans. (c)*
6. *Ans. (a)*
7. *Ans. (a)*
8. *Ans. (b)*

$$\frac{P}{\Delta V/V} = k = \frac{E}{3(1-2\mu)}$$

as $\mu \uparrow \rightarrow k \uparrow \rightarrow \Delta V \downarrow$

9. *Ans. (a)*
10. *Ans. (d)*
11. *Ans. (b)*
12. *Ans. (c)*
13. *Ans. (b)*
14. *Ans. (b)*
15. *Ans. (b)*
16. *Ans. (d)*
17. *Ans. (c)*
18. *Ans. (b)*
19. *Ans. (a)*
20. *Ans. (b)*

$$\sigma_{ultimate} = \frac{\text{load}}{\text{original cross sectional area}}$$

$$= \frac{8}{1} = 8 \text{ tonnes/cm}^2$$

21. *Ans. (d)*
22. *Ans. (b)*
23. *Ans. (d)*

$$E = \frac{\sigma}{\varepsilon} \text{ when } \varepsilon = 1 \Rightarrow \sigma = E$$

24. *Ans. (d)*
25. *Ans. (b)*
26. *Ans. (d)*
27. *Ans. (c)*
28. *Ans. (d)*
29. *Ans. (d)*
30. *Ans. (b)*

$$K = \frac{P}{\Delta V/V} = \frac{\sigma}{\varepsilon_v}$$

31. *Ans. (b)*
32. *Ans. (b)*
33. *Ans. (a)*
34. *Ans. (a)*
35. *Ans. (a)*
36. *Ans. (d)*
37. *Ans. (d)*
38. *Ans. (a)*
39. *Ans. (d)*
40. *Ans. (b)*
41. *Ans. (b)*
42. *Ans. (d)*
43. *Ans. (b)*
44. *Ans. (c)*
45. *Ans. (a)*
46. *Ans. (d)*
47. *Ans. (c)*
48. *Ans. (d)*

$$\mu = -\left(\frac{\text{Lateral strain}}{\text{Longitudinal strain}}\right)$$

$$\text{Lateral strain} = -\mu \text{ longitudinal strain}$$

49. *Ans. (b)*
50. *Ans. (b)*
51. *Ans. (d)*
52. *Ans. (b)*

ENGINEERS ACADEMY

53. ***Ans (c)***

Stress relaxation is decrease in stress in response to same amount of strain. This is because structure is kept in strained condition for some finite interval of time

54. ***Ans (b)***

55. ***Ans. (d)***

56. ***Ans. (a)***

$$E = 3k\,(1-2\mu)$$

57. ***Ans. (a)***

58. ***Ans. (b)***

$$E = 2C(1+\mu)$$

$$1.25 \times 10^{11} = 2C[1.34]$$

$$1.25 \times 10^{11} = 2.68 \times C$$

$$0.4664 \times 10^{5}\ \text{MPa} = C$$

59. ***Ans. (a)***

$$E = 2 \times 10^{6}\ \text{kg/cm}^2$$

$$C = 0.8 \times 10^{6}\ \text{kg/cm}^2$$

$$E = 2C(1+\mu)$$

$$2 \times 10^{6} = 2 \times 0.8 \times 10^{6}\,(1+\mu)$$

$$\frac{2}{1.6} = 1+\mu$$

$$1.25 = 1+\mu$$

$$\mu = 0.25$$

60. ***Ans. (d)***

61. ***Ans. (a)***

$$E = 2C\,(1+\mu)$$

$$125 = 2C\,[1.25]$$

$$125 = 2.50C$$

$$\frac{125}{2.50} = C$$

$$50 = C$$

62. ***Ans. (d)***

63. ***Ans. (a)***

64. ***Ans (b)***

Proof resilience : Strain energy stored upto elastic limit.

65. ***Ans. (b)***

66. ***Ans. (d)***

67. ***Ans. (d)***

$$(\text{Strain energy})_{\text{shaft}} = \frac{1}{2} \times T \times \theta \qquad \ldots(i)$$

From torsion equation

$$\frac{T}{J} = \frac{\tau_s}{R} = \frac{G\theta}{l}$$

$$\theta = \frac{TL}{GJ}$$

From equation (i)

$$(S.E)_{\text{shaft}} = \frac{1}{2} \times T \times \frac{TL}{GJ}$$

$$(S.E)_{\text{shaft}} \propto \frac{1}{GJ}$$

68. ***Ans. (c)***

Isotropic material = Same elastic property in all direction at a given point

69. ***Ans. (d)***

70. ***Ans. (d)***

71. ***Ans. (c)***

C.I is brittle material and brittle material along have fracture along oblique plane.

72. ***Ans. (a)***

$$I_{xx} = \frac{bd^3}{12} = \frac{80 \times 10^3}{12}$$

$$= 6666.66\ \text{mm}^4$$

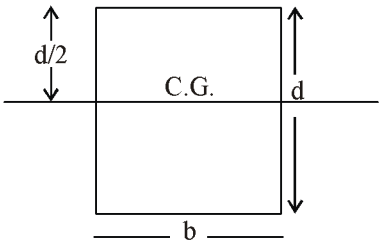
73. ***Ans. (a)***

74. ***Ans. (c)***

75. ***Ans. (d)***

76. ***Ans. (a)***

77. ***Ans. (b)***



$$I_{base} = I_{CG} + Ay^2$$

$$= \frac{bd^3}{12} + (bd) \times \left(\frac{d}{2}\right)^2$$

$$= \frac{bd^3}{12} + \frac{bd \times d^2}{4}$$

$$= \frac{bd^3}{12} + \frac{bd^3}{4} = \frac{4bd^3}{12}$$

$$I_{base} = \frac{bd^3}{3}$$

$$\frac{I_{C.G.}}{I_{base}} = \frac{bd^3 \times 3}{12 \times bd^3}$$

$$\frac{I_{C.G.}}{I_{base}} = \frac{1}{4}$$

78. ***Ans. (b)***

79. ***Ans. (b)***

80. ***Ans. (d)***

81. ***Ans. (a)***

82. ***Ans. (d)***

83. ***Ans. (b)***

84. ***Ans. (a)***

85. ***Ans. (a)***

86. ***Ans. (b)***

87 ***Ans. (b)***

88. ***Ans. (c)***

89. ***Ans. (d)***

90. ***Ans. (a)***

91. ***Ans. (d)***

92. ***Ans. (b)***

93. ***Ans. (c)***

94. ***Ans. (b)***

95. ***Ans. (d)***

96. ***Ans. (d)***

97. ***Ans. (d)***

$G = 100$ GPa

$\mu = 0.25$

$E = 2G[1 + \mu]$

$= 2 \times 100 \times [1 + 0.25]$

$= 2 \times 100 \times 1.25$

$= 2.50 \times 100$

$= 250$ GN/m^2

98. ***Ans. (a)***

$E = 200$ GN/m^2

$\mu = 0.25$

$E = 2G[1 + \mu]$

$$G = \frac{E}{2[1+\mu]} = \frac{200}{2 \times 1.25}$$

$= 80$ GN/m^2

99. ***Ans. (c)***

100. ***Ans. (c)***

101. ***Ans. (a)***

102. ***Ans. (b)***

103. ***Ans. (d)***

104. ***Ans. (b)***

105. ***Ans. (a)***

106. ***Ans. (c)***

107. ***Ans. (d)***

108. ***Ans. (a)***

109. ***Ans. (c)***

110. ***Ans. (a)***

111. ***Ans. (c)***

112. ***Ans. (a)***

113. ***Ans. (c)***

114. ***Ans. (c)***

115. ***Ans. (d)***

116. ***Ans. (c)***

ENGINEERS ACADEMY

117. *Ans. (a)*

118. *Ans. (d)*

119. *Ans. (c)*

120. *Ans. (a)*

121. *Ans. (a)*

122. *Ans. (d)*

$$\varepsilon_t = \ln\left(\frac{A_0}{A_r}\right) = 2\ln\left(\frac{d_0}{d_r}\right)$$

$$= 2\ln\left(\frac{5}{4}\right) = 0.446$$

123. *Ans. (a)*

$$\text{Engineering Strain} = \frac{\Delta L}{\text{Initial Length}}$$

$$\varepsilon_{eng} = \frac{\Delta L}{L} = \frac{2L - L}{L} = 1$$

$$\varepsilon_T = \ln(1 + \varepsilon_{eng})$$

$$= \ln(1 + 1) = 0.693$$

124. *Ans. (c)*

$D = 100$ mm, $L = 500$ m

$P = 1000$ kN

$G = ??$

$E = 2 \times 10^5$

$E = 2G[1 + \mu]$

$E = 2 \times G[1 + 0.3]$

$2 \times 10^5 = 2 \times G \times 1.3$

$G = 0.7692 \times 10^5$ N/mm^2

125. *Ans. (c)*

126. *Ans. (b)*

127. *Ans. (b)*

128. *Ans. (d)*

129. *Ans. (a)*

$$E = 2G(1 + \mu)$$

$$\frac{E}{G} = 2(1 + 0.2) = 2.4$$

$$\frac{E}{G} = \frac{12}{5}$$

130. *Ans. (b)*

131. *Ans. (c)*

$E = 200$ GPa

$G = 80$ GPa

$E = 2G(1 + \mu)$

$200 = 80 \times 2(1 + \mu)$

$$\frac{200}{160} - 1 = \mu$$

$$\mu = \frac{40}{160} = \frac{1}{4} = 0.25$$

132. *Ans. (c)*

133. *Ans. (c)*

134. *Ans. (c)*

135. *Ans. (c)*

136. *Ans. (b)*

137. *Ans. (b)*

138. *Ans. (d)*

According to Hooke's low

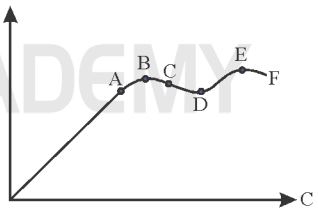
Stress μ Strain

$\sigma \propto e$

$\sigma = Ee$

$$E = \frac{\sigma}{e} = \frac{\text{Stress}}{\text{Strain}} = \frac{F/A}{\Delta l/1}, \text{ or } \Delta \ell = \frac{F\ell}{AE}$$

139. *Ans. (a)*



A = Proportional limit

B = Elastic limit

C = Yield point

E = Fracture point

140. *Ans. (b)*

The elastic limit of brittle materials is comparatively low, there is no yield point in brittle materials.

ENGINEERS ACADEMY

141. ***Ans. (a)***

142. ***Ans. (d)***

$$\text{Strain} = \frac{\text{change in dimension}}{\text{original dimension}}$$

Strain is a dimensionless and unitless quantity.

143. ***Ans. (b)***

Longitudinal strain

$$e_1 = \frac{\Delta l}{l} = \frac{l_2 - l_1}{l_1}$$

$\because \quad l_2 = 2l_1$

$$e_1 = \frac{2l_1 - l_1}{l_1} = 1.0$$

144. ***Ans. (d)***

$$\frac{\Delta V}{V} = \frac{\sigma}{E}(1 - 2\mu)$$

$\because \quad \frac{\Delta V}{V} > 0$ (Always)

$$\frac{\sigma}{E}(1 - 2\mu) > 0$$

$$1 - 2\mu > \frac{0 \times E}{\sigma}$$

$$1 - 2\mu > 0$$

$$\boxed{\mu < 0.5} \text{ or } \boxed{\mu < \frac{1}{2}}$$

145. ***Ans. (c)***

146. ***Ans. (d)***

147. ***Ans. (c)***

$$E = 2G(1 + \mu)$$

$$\frac{E}{G} = 2(1 + 0.4) = 2 \times 1.4 = 2.8$$

$$\frac{E}{G} = 2.8 = \frac{14}{5}$$

148. ***Ans. (d)***

149. ***Ans. (c)***

In a rigid body modulus of elasticity is equal infinite because in it value of strain is zero.

150. ***Ans. (d)***

151. ***Ans. (d)***

152. ***Ans. (c)***

Length of cylindrical bar = LM deformation due to axially load = l mm.

Then $\text{Strain} = \frac{\text{Elongatinon in length}}{\text{Initial length of Rod}}$

$$= \frac{\ell \text{ mm}}{\text{Lm}}$$

$$= \frac{\ell}{1000\text{L}} \text{ OR } 0.001\left(\frac{\ell}{\text{L}}\right)$$

153. ***Ans. (d)***

$$\text{Lateral strain} = \Delta d/d = \left(\frac{0.05}{10}\right) = 0.005$$

$$\text{Longitudinal strain} = \Delta l/l = (0.8/40) = 0.02$$

$$\text{Poisson Ratio} = \frac{\text{Lateral strain}}{\text{Longitudnal strain}}$$

$$\mu = \frac{0.005}{0.02} = 0.25$$

154. ***Ans. (b)***

155. ***Ans. (d)***

❑❑❑

Introduction
SCAN ME